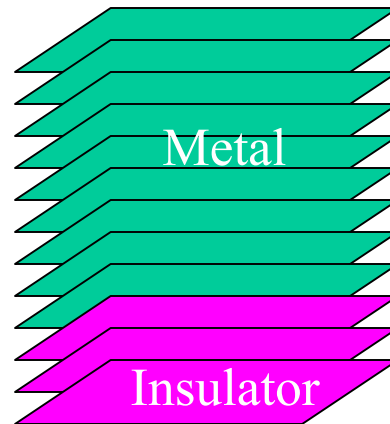
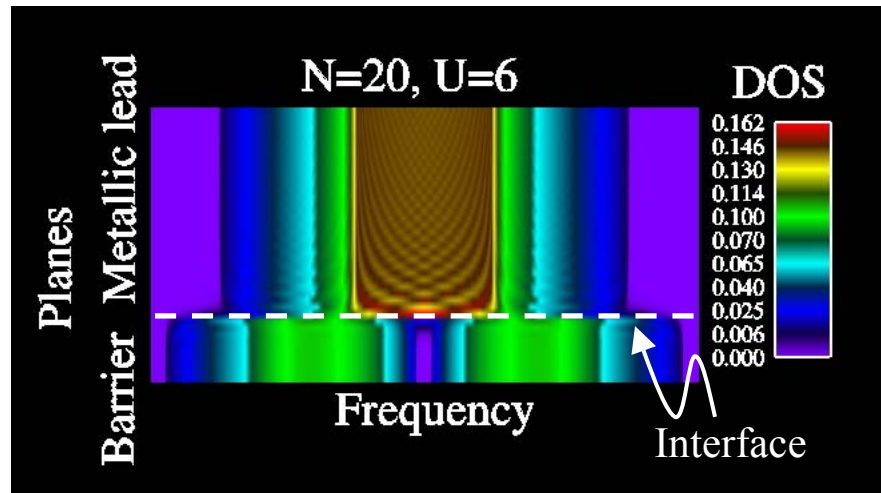


# Density of states in nanostructures

PI's: J. K. Freericks (Georgetown), A. Y. Liu (Georgetown), and B. A. Jones (IBM)

*Nanotechnology interdisciplinary research team DMR-0210717*



The nanostructure is made out of planes of metal (green) stacked on top of an insulator (magenta) and then stacked on top of the metal again. We only picture the upper half of the nanostructure here.

Like the ripples that appear in a pond after a stone is dropped, the quantum mechanical wavefunctions of a metal also develop ripples (yellow and black region in the center) when they are connected to an insulator of finite thickness. A trench survives in the insulator (purple region in the lower center), whose properties determine how easily electricity is transmitted through the nanostructure. By choosing the insulator to be a special class of materials called a Mott insulator, the electrical properties can be engineered on the nanoscale and tuned by varying the temperature or by squeezing (applying pressure). In the left figure, we show the upper half of a metal-insulator-metal nanostructure composed of vertically stacked planes, with the insulator being 6 nm thick (the figure shows 9 nm of the upper metal and 3 nm of the insulator, allowing us to concentrate on one of the metal-insulator interfaces, highlighted by the white dashed line).

For more details, see <http://www.physics.georgetown.edu/~jkf/nirt.html>

# Industrial apprenticeship and education assessment

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**Ling Chen**, a graduate student in the *Industrial Leadership in Physics* program has completed his apprenticeship at IBM's Almaden research center. He worked on current-induced domain-wall motion for metallic nanostructures fabricated in Stuart Parkin's laboratory; now he is calculating the capacitance of nanostructures. **Alexander Joura** has started his apprenticeship under the direction of Barbara Jones. He is currently working on Kondo-effect problems related to the experimental work of Don Eigler.

We have begun our assessment project into the long-term learning of former students of *The Quantum World Around Us*, a materials science course for nonscientists. An undergraduate **Ron Stimmel** helped prepare interview materials and protocols for student volunteers. We have completed one student interview, and plan more over the coming year. This work is in collaboration with **Stamatis Vokos** of Seattle Pacific University.



*Alexander Joura and Barbara Jones at IBM's Almaden Research Center for Alexander's industrial apprenticeship which is required for the Industrial Leadership in Physics program.*



*Freericks interviews a student volunteer on the quantum mechanics of the two-slit experiment.*